Canada

DESIGN GUIDELINES FOR MEETING THE ACCESS NEEDS OF BLIND AND VISUALLY IMPAIRED TRAVELLERS IN TRANSPORTATION TERMINALS

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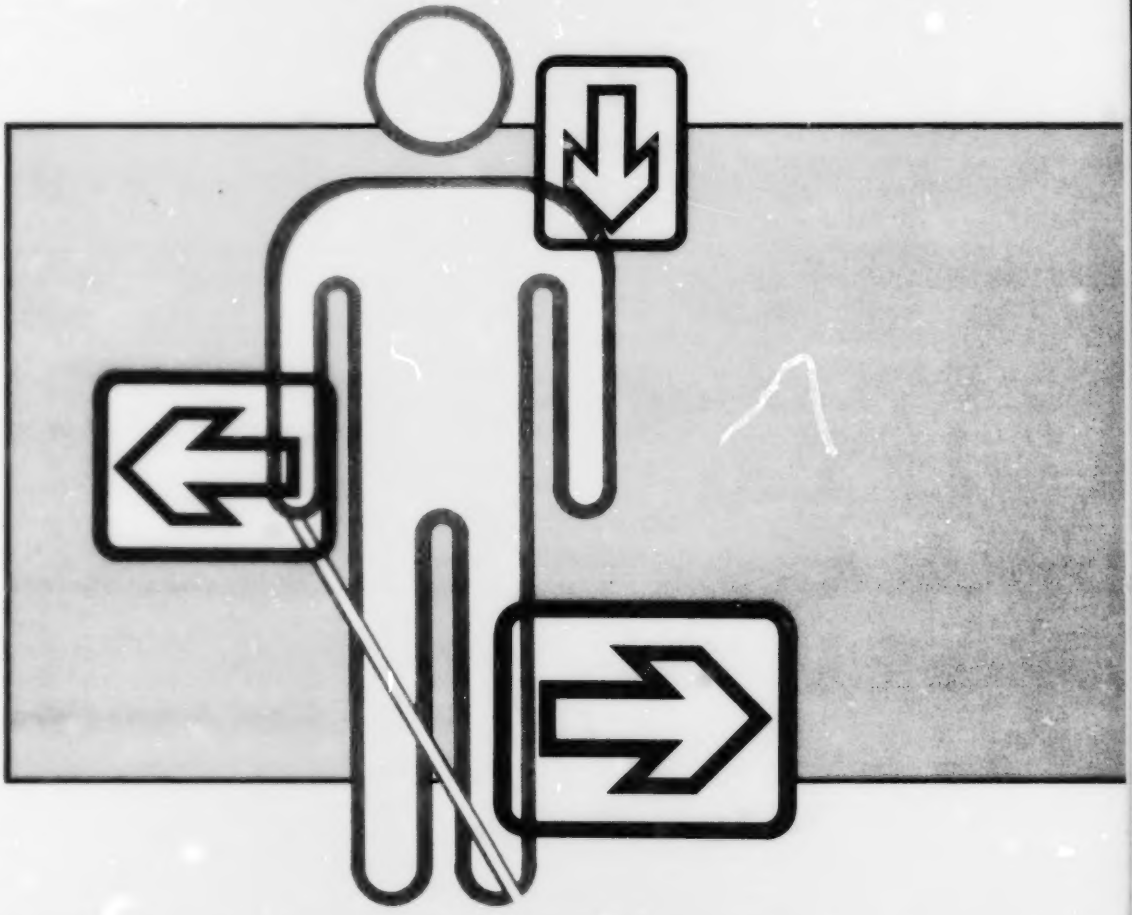

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Design Guidelines for Meeting the Access Needs of Blind and Visually Impaired Travellers in Transportation Terminals

by

The Canadian National Institute for the Blind

and

Transportation Development Centre
Policy and Coordination Group
Transport Canada

December 1989

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16. Abstract

This report presents design recommendations and guidelines for meeting the access needs of blind and visually impaired travellers in transportation terminals. It describes how blind and visually impaired persons orient themselves and move through an environment. The report reveals various problems faced by the visully impaired in travelling unassisted from place to place.

Orientation and mobility are defined vis-à-vis how blind and visually impaired persons travel. The use of mobility aids (guide dog, white cane, electronic devices, etc.) and of sensory information (visual, tactual and auditory) to effect safe and graceful travel through an environment is described and discussed.

Specific design recommendations for many architectural elements of transportation terminals are presented.

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16. Résumé

Ce document présente des lignes directrices et des recommandations pour l'adaptation des installations terminales de transport aux besoins des aveugles et des autres handicapés visuels. Il décrit quelques méthodes utilisées par cette catégorie de voyageurs pour s'orienter et se déplacer. L'auteur démontre, exemples à l'appui, les problèmes d'aménagement intérieur et extérieur auxquels sont confrontées les personnes souffrant d'un handicap visuel.

Les mécanismes d'orientation et la mobilité des handicapés visuels sont définis dans le contexte des déplacements qu'ils doivent faire. L'auteur aborde également l'utilisation des aides à la mobilité (canne blanche, chien-guide, dispositifs électroniques, etc.) et les indices sensoriels (visuels, tactiles et auditifs) requis par les handicapés visuels pour leur permettre de se déplacer en toute sécurité et avec dignité dans les lieux publics.

Par ces nombreuses recommandations, ce document vise surtout à améliorer l'accessibilité des transports aux aveugles et aux malvoyants.

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PREFACE

This publication is an adaptation of a document prepared by the Canadian National Institute for the Blind for the Transportation Development Centre of Transport Canada. The design recommendations contained herein form part of this larger report entitled *"Access Needs of Blind and Visually Impaired Travellers in Transportation Terminals: A Study and Design Guidelines"*, TP 9048E, published in December 1987.

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INTRODUCTION

The issue of accessibility by disabled persons to various modes of transportation has received increasing attention in recent years. Considerable energy, funding, and research have been directed toward the environmental access needs of disabled Canadians. Much of this attention has been directed toward removing architectural barriers for the individual who is confined to a wheelchair, or who is otherwise mobility impaired. However, similar efforts for sensory impaired Canadians have been lacking. There is a need to identify the environmental access needs of sensory impaired travellers so that they may use transportation terminals with the efficiency, convenience, and dignity comparable to that experienced by sighted travellers (1)*. Specifically, efforts must be made to assist visually impaired persons to travel independently, taking into consideration the effects of the environment on safe and efficient movement (2). Building designers are only beginning to recognize and acknowledge the needs of visually impaired persons.

The limited focus on access issues for visually impaired persons may be due, in part, to the fact that they are not normally denied access to transportation facilities because of architectural barriers. Rather they have accessibility difficulties due to the problems of orientation to new, and often large, transportation terminals. Visually impaired persons need to know where they are and how to reach a desired destination quickly and safely; or how to obtain needed information. The information necessary to resolve orientation problems is often lacking or inaccessible. Solutions to orientation problems are possible through: appropriate visual, auditory, tactile, and kinesthetic cues; speech, large print or braille technologies; and trained human resources. Clear, simple designs and direct, easy-to-access information systems are required to create an environment that meets the orientation and mobility needs of visually impaired persons. An environment thus created has the added benefit of also being a better environment for the general public.

It is estimated that there are at least 552 000 visually impaired persons in Canada (Statistics Canada, Health & Activity Limitation Survey, 1986). Of these, 10 percent are totally blind or are without the presence of some usable vision. Because aging and vision are related, the incidence of blindness and visual impairment will increase as the general population ages.

* Numbers in brackets designate references listed at the end of the report.

This report presents design recommendations and guidelines with the goal of improving accessibility to public transportation for the visually impaired. While the scope of the report is limited to transportation terminals, practical application exists for the broader elements of the recommendations to improve access for visually impaired persons in all environments.

For the purposes of this report, the term *"visually impaired"* denotes those individuals who are totally blind or have low vision.

Part I of the report presents general design recommendations. Part II outlines specific recommendations for many architectural elements based on these general recommendations.

Part I

GENERAL DESIGN RECOMMENDATIONS

1.1 INTRODUCTION

The philosophy behind the design recommendations contained in this report is one of reasonable access to transportation terminals. Society must continue to provide and upgrade appropriate educational and training opportunities for visually impaired persons in order to provide them with the necessary skills and problem-solving tools to adapt to living in an environment designed primarily for sighted persons. At the same time, within the guiding principle of reasonable access, there is a great deal that can be done — for the most part at reasonable cost — to enhance our current travel environments.

A well-designed environment supports effective orientation and mobility: It is clearly organized; free of hazards; and presents adequate information about location and direction. Criteria for design modifications to aid visually impaired travellers must respond to their need to travel independently, safely and purposefully (3).

Building designers must give consideration to the needs of visually impaired travellers when buildings are in the initial stages of design (4). Designers must recognize that visually impaired persons can function independently in the mainstream of society, and question the predominant reliance upon vision to direct the travelling public. In this way inequities in ease of access can be prevented (1). Current way-finding literature states that buildings which are poorly designed tend to rely far too much on a barrage of visual signage in an attempt to resolve the general public's confusion. However, rather than resolving the confusion, this information overload often results in more frustration and confusion. Similarly, an element of a building placed correctly in the design stage, will not require that a costly — and possibly unsightly — safety-rail be added to it after construction is finished.

We present here a set of perspectives from which to address transportation terminal design for the greater good of both visually impaired and sighted travellers.

1.2 CONSULTATION TEAM

To assist designers, we recommend the formation of a consultation team. The information in this manual cannot be used effectively in isolation. Many of the recommendations made must be carefully weighed with respect to specific environments and user requirements.

Recommendations

(i) Form a local consultation team to provide detailed, on-site analysis of the environment and to provide specific input on accessibility for the site in question.

(ii) Select for the team several visually impaired consumers; an orientation and mobility specialist; a low-vision specialist; and appropriate building management and design specialists.

1.3 ORIENTATION

On first contact with a new environment, visually impaired people use a sequential strategy to find their way. That is, they follow a memorized route without knowing the spatial relationships of the rooms they are walking through. This is much the same way a driver follows instructions to reach an unfamiliar area ("go straight, past two traffic lights, turn right ..."). Thus a sequential strategy emphasizes a string of landmarks without providing the relationship between them (3).

Recommendations

(i) A good building design is one easily understood by people with impaired vision. Include design elements which assist visually impaired travellers such as:

- *consistency and uniformity,*
- *well-defined and detectable paths and landmarks,*

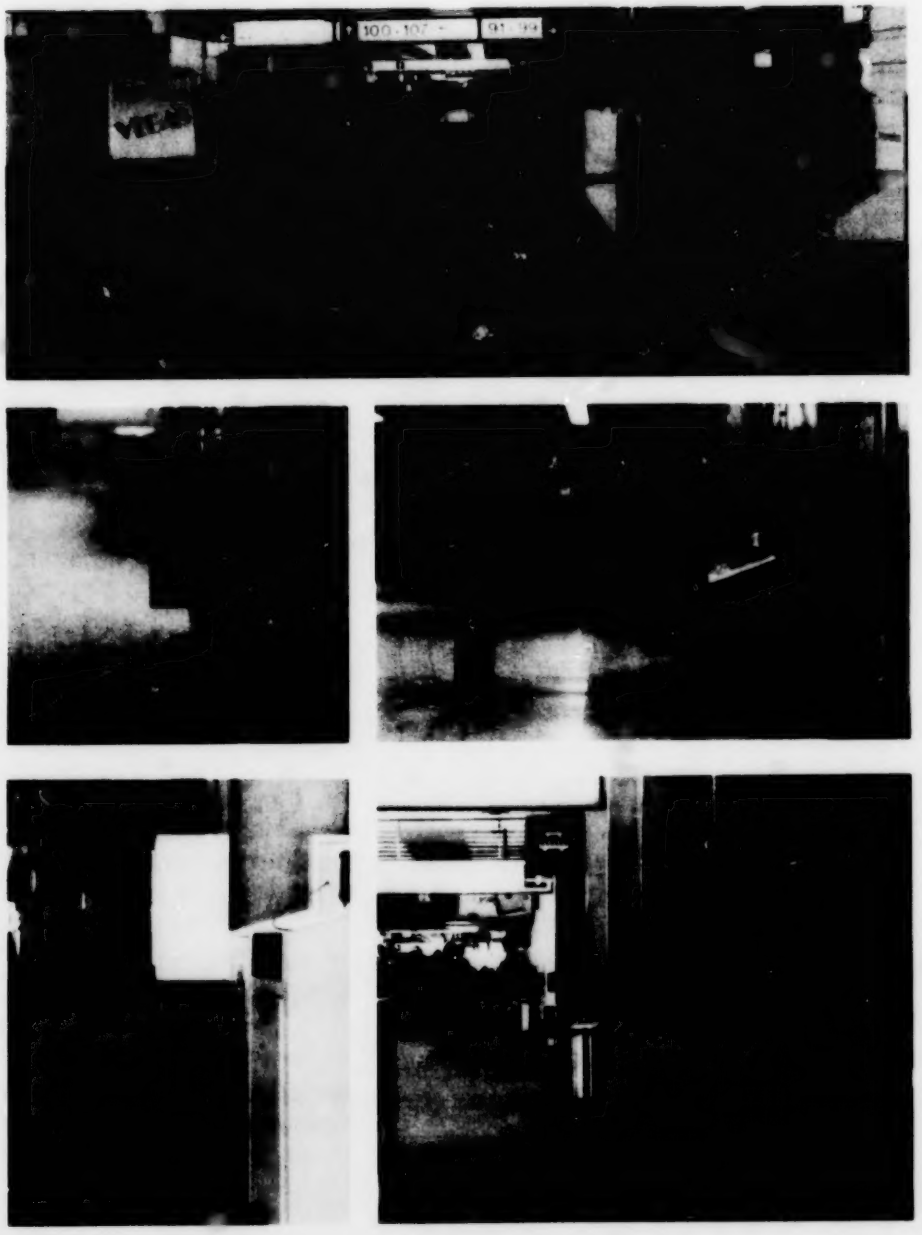


Figure 1 Examples of travel hazards

- *building plan, pavements, roads and paths kept to a right-angled system,*

- *elevators, stairs, and reception desks readily accessible.*

(ii) Break down large open areas into smaller areas. This can be achieved by the placement of furniture and/or the use of distinctly different floor surfaces e.g. colour, resiliency, textural, sound contrast. The texture, illumination, colour, and sound absorption qualities of the walls and ceiling can also be varied in order to create sensory differentiations of large spaces.

(iii) Eliminate large unmarked expanses of glass and mirrored surfaces. Such surfaces are particularly confusing and disorienting to the low-vision traveller.

(iv) Provide advance travel information via telephone; provide portable orientation aids upon request.

1.4 MOBILITY

Directed and purposeful travel for a visually impaired person involves not only orientation to the environment, but also the ability to manoeuvre safely around obstacles and travel hazards.

An obstacle is defined as an architectural or environmental obstruction in the path of travel that can be easily detected and negotiated with standard long cane techniques, effective use of residual vision or other mobility techniques. (The long cane can only detect objects that are at waist height or below, and even objects at waist level are generally not detectable within a safe warning distance.) The environment is full of obstacles for the visually impaired traveller.

A travel hazard is defined as an architectural or environmental obstruction in the path of travel that cannot be easily detected and negotiated with standard long cane techniques, effective use of residual vision or other mobility techniques. Figure 1 gives some examples.

What may appear straightforward to the fully sighted traveller, may be confusing and difficult to travel through for the visually impaired traveller.

Recommendations

(i) Understand the mobility needs of visually impaired persons.

(ii) Analyze building features from the perspective of these needs to minimize obstacles and eliminate travel hazards.

1.5 SENSORY INFORMATION

It is good practice to pair visual information about the environment with non-visual sensory information. For example, if a decision is made to use textured, warning surfaces underfoot, these surfaces should include a highly colour/brightness contrasted, visual component. This pairing of non-visual cues with visual cues enables travellers to confirm their visual perceptions and to compensate for visual distortion by integrating their vision with other sensory information.

Recommendations

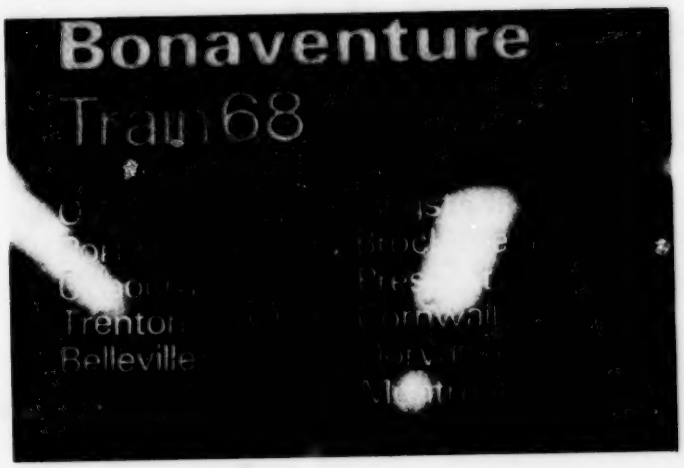
(i) Use only very high-quality visual information: e.g. make optimum use of colour/brightness contrast to enhance the environment; avoid visual noise; use proper illumination; eliminate glare through the use of matte and non-glare surfaces; ensure good contrast between printed information and its background; use recommended proportions for letters and signs (3). (See Figure 2.)

(ii) Provide non-visual information to supplement and enhance the visual environment. Consider the use of sound, air movement, smell, tactile information, etc., for communicating with and directing travellers.

(iii) Where possible, pair non-visual sensory information with visual information.

A woman is able to read orientation signage in a terminal by using her low-vision aid, a monocular

A very good example of signage which is also tactual. The sign has a matte non-glare surface



The placement of this sign and its shiny surface characteristics create so much glare that parts of it are illegible

Figure 2 Examples of well and poorly designed signage

1.5.1 Vision

(a) Colour/Brightness Contrast

Lighting and colour schemes cannot be treated separately. Even optimum illumination may not assist a visually impaired person to travel safely through an environment if objects and their surrounding areas present very little colour/brightness contrast. The level of light must not be over-powering or misdirected so as to cause glare; glare tends to veil and minimize colour contrast.

Colour is a complex, subjective phenomenon even for the normally sighted individual. The effects of specific eye conditions on vision and the ability to detect colours have not been clearly established. It is known that many eye conditions cause distortion of colour vision; however, due to the uniqueness of each individual's low vision, specific colour deficits have not been uniformly linked to specific eye conditions.

Colour is specified by its three components; hue, saturation or chroma, and brightness or intensity. Hue is the sensory correlate of wave length. The names of the primary colors designate hues. Saturation or chroma refers to the strength or richness which a hue appears to possess. A stronger hue is said to be more saturated. Mixing white light with a color dilutes it: white added to red turns it pink. Brightness or intensity is the relative amount of light reflected by a particular hue. Brightness value can be altered while hue and chroma remain constant.

Recommendations

(i) Use yellow, orange or white on a dark or black background to achieve optimum visibility for the majority of the visually impaired as well as the normally sighted population (1). Yellow and orange appear to be the most discriminable colours (hues) to the normal eye, the aging eye, the visually impaired eye, and the colour-blind eye (5) (6) (7).

(ii) When designing with colour against surrounding backgrounds, unnecessary visual clutter and confusing pattern must be eliminated. Many visually impaired persons experience figure-ground confusion.

(iii) Carefully selected colour should be used to emphasize important features in a room and to assist with orientation. Efficient and consistent use of a planned colour scheme can make orientation and travel safer and more effective. For instance, a single colour

should be used for all emergency exits from a building and all emergency apparatus such as: fire alarm stations, direct-line telephones, and first-aid equipment. Efficient planning of colour scheme systems can result in an environment which is both aesthetically pleasurable and systematically efficient.

(iv) Use colours which contrast in brightness and hue to make signs and room numbers more visible, to contrast door knobs and frames from the surrounding wall area, to call attention to the area leading to staircases and to step edges, to make handrails stand out from the surrounding wall surface, and to highlight the edge of open railway platforms and other drop-off areas (8).

(v) Use colour coding to assist with way finding. A complex terminal might colour code certain wings to assist with orientation.

(vi) Where possible, pair colour with other sensory information, e.g. a coloured lip of the step edge paired with a discriminable texture.

(vii) Where colour/brightness contrast is used, the colours should differ in brightness value from each other by a factor of at least 70 per-cent based upon the following formula:

$$\text{Contrast} = \frac{B1 - B2 \times 100}{B1}$$

Where $B1$ = *reflectance of brighter area*
$B2$ = *reflectance of darker area*

(b) Illumination

There are no reliable rules governing the level of illumination required by individuals with various eye pathologies. Individual lighting requirements vary considerably, even among patients with the same eye pathologies. However, most experimental research substantiates the fact that although a few eye pathologies may require reduced levels of illumination, most visually impaired persons benefit from increased levels of illumination.

While illumination must be adequate to enable visually impaired persons to utilize their vision effectively, it must also be directed and controlled so that it does not create glare.

Several factors influence the capacity of a visually impaired person to see objects in the environment. These include: the time available to focus accurately on an object; the size of the object; the brightness of the object; and the contrast between the object and its immediate background.

Recommendations

(i) *Illumination levels must be adequate to enable the greatest number of visually impaired persons to utilize their vision effectively. The Illuminating Engineering Standards (IES) for transportation terminals should be followed.*

(ii) *Lights must be directed and controlled so that they do not create glare. A poorly placed sign can be made illegible by glare reflecting from its surface. The light source must be evenly distributed on the object or environment being viewed rather than being focussed directly into the viewer's eyes.*

(iii) *Matte finishes should be used in the environment in preference to highly-reflective, glare-promoting surfaces. These surfaces include highly polished furniture or flooring, shiny metals, glass and mirrored or ceramic-tile surfaces.*

(iv) *An environment should present a constant level of adequate illumination to pedestrians as they move from one part of the terminal to another. Illumination levels should be constant from one room to the next. On a bright day large windows which are not tinted or shielded can cause serious illumination level inconsistencies in a room.*

(v) *Particular attention should be given to areas such as elevators, stairs and landings which are often inadequately lit in comparison to the rooms opening onto them (9).*

(vi) *Use light to accentuate signage, stairs, handrails, and other decision-making points.*

(vii) *Use decor and colour to regulate and enhance the light available in a room. Most of the light that enters our eyes has not come directly from its source but has been reflected off the ceiling and walls and off objects in the room (9). Light-coloured decors reflect more light while dark-colour decors tend to absorb the light in a room.*

1.5.2 Audition

Audition is especially important to a visually impaired person. Hearing, like sight, is a long-distance sense which can tell an individual what is farther out in the environment. It helps to appreciate depth by identifying the existence of space and the distance through space to a sound-reflecting surface or a sound-emitting object. A person can learn to use reflected sound to determine whether a room is large or small and to infer the type of furnishings present (10).

Recommendations

(i) *Use carpets, acoustical tiles and furniture in moderation to reduce sound glare (i.e. high levels of echo reflection and ambient sound) in a room without creating an acoustically dead environment. Some degree of sound reverberation is necessary to get the feel for a space; therefore, the use of both carpets and acoustical ceiling tile in a moderately used corridor should be avoided.*

(ii) *Break down large areas into a succession of smaller areas which are more easily negotiated by a visually impaired person. Use a series of continuous sound producing beacons (water fountains, escalators, etc.) to create an overlapping guidance system of non-visual landmarks.*

(iii) *Screen noise sources to ensure that sounds intended to give directional guidance are not masked by undesirable noise emissions. Air conditioning units, electrical transformers or service entrances may mask the sounds intended to give directional guidance in a busy terminal. Sound cues are frequently taken from sounds emitted by elevators, escalators and exit doors (11).*

(iv) *A well designed aural environment strives to keep noise that is generated outside from entering an interior sound pattern; and to keep sound that is generated inside from bouncing around and creating undesirable background noise. Glass, unless it is double-spaced acoustic glass, is a particularly poor sound buffer and should be used with caution.*

(v) *Consider how your planned circulation paths will stand out when defined by a sound pattern energized by a tapping cane. Remember that recessed doors can be echo identified, different floor coverings reflect different sounds, and cross halls may be perceived by a sudden absence of reflected sound.*

1.5.3 Touch

The sense of touch also serves as an important source of environmental information for a visually impaired person. For the totally blind person this source of sensory information is, in most situations, secondary only to audition. The visually impaired person with usable vision relies on the sense of touch to backup and confirm information received through vision and/or audition. For the deaf-blind person the sense of touch must play a primary role in providing environmental information.

Recommendations

(i) The sense of touch presents information in a serial and fragmented form when compared to vision. To assist with the understanding of spatial relations in a setting, the design should follow wayfinding principles and utilize simple, right-angle configurations for room layout.

(ii) Tactile cues such as detectable floor or wall surfaces should be of sufficient dimension to allow a visually impaired person adequate time to sense and react to the surface while moving through the terminal.

(iii) Tactile cues utilized for warning surfaces must be clearly differentiated from other surfaces in the setting and must be located consistently throughout the setting. Installation must occur in one time period throughout the setting. The tactile warning surface must be clearly detectable under both foot and cane.

(iv) Tactile/low vision graphic maps should be made available to visually impaired persons. These should be portable and be designed for optimum usability. Their development should follow established guidelines in the literature and be undertaken through input from the local consultation team.

(v) Tactual orientation cues should be presented in the environment paired with other sensory information. The walls leading into a specific wing of a building might not only feel different to the sense of touch, they might also be painted a different colour and provide a different sound quality.

(vi) Extremely uneven, rough or sharp surfaces should not be utilized for wall surfaces. These surfaces are unpleasant to the sense of touch and can interfere with any necessary trailing of the surface.

Part II

SPECIFIC DESIGN RECOMMENDATIONS

2.1 INTRODUCTION

The general principles of design presented in Part I are reinforced in the specific remarks that follow. Current Canadian standards do not deal with visual impairment and access issues in sufficient depth. The information included here is meant to supplement existing accessibility standards with regard to access for visually impaired persons. The recommendations deal specifically with visual impairment and access issues and do not address accessibility needs specific to other disability groups. Therefore, they must also be applied in conjunction with the broader existing standards and recommendations that have been developed for all disabled persons.

The recommendations listed below should be used in conjunction with the guidelines cited in the British Columbia Building Code (12) except where differences and additions are noted. (The British Columbia Building Code has taken a progressive and informed leadership role in Canada regarding accessibility recommendations specific to the needs of visually impaired persons. In developing specific design recommendations for our report, we have elected to draw from this Code whenever possible. We believe that the British Columbia Building Code has made an excellent contribution toward increasing environmental accessibility for visually impaired persons.) Where information is quoted from another building code or standard, that source is identified.

2.2 INTERIOR

2.2.1 Entrances

(a) Entrances should be situated centrally and in such a way that they are easy to find. In order that they may be seen from a distance, they should be colour/brightness contrasted from the surrounding area. Appropriate signage (see 2.2.7) should clearly designate the building entrance. Accessible building entrances should lead to a main lobby or main corridor.

(b) Main entrances should connect with public transportation stops, accessible parking, passenger loading zones and/or public streets or side-

walks. The entrance should be approachable by a safe pedestrian walkway. Access routes to the building entrance from public transportation stops should not require travellers to cross a parking lot, nor walk behind parked cars.

(c) Information desks, signs, etc., must be consistently placed and readily located.

(d) Entry doors should comply with recommendations contained in 2.2.13. There should be no step up or down immediately on either side of an entry door.

(e) Entrance ways should be illuminated with transitional illumination. In the case of a glass exterior door, the exterior light should be diffused and attenuated by means of light diffusing materials (13). Visually impaired persons frequently experience light adaptation concerns, especially if a dark corridor leads to a brightly illuminated exterior door; a plate glass door on a bright sunny day, for example.

2.2.2 Lobbies/Open Areas

(a) Where possible, large open areas should be divided into smaller, regular right-angled spaces. This can be done through the effective use of: acoustical ceiling and wall treatments, detectable floor textural differences, and landscaping and furniture arrangement. All landscaping and furniture treatments should be out of main travel passageways and should comply with clearance dimensions cited in 2.2.3.

(b) Large open areas that have functional, main circulation routes should define these routes with detectable, floor surfaces. (See Figure 3.) These surfaces should be differentiated from the surrounding flooring by use of one or more of the following: colour/brightness contrast, auditory cues, resiliency, and/or texture. The surfaces should feature a matte, non-glare finish. One example of this differentiation is light-coloured vinyl flooring utilized for the main circulation route in a lobby otherwise covered with dark carpeting. Textured surfaces used throughout a building must be consistent and be clearly distinguishable from detectable warning surfaces described in 2.2.5.

(c) All queue areas should be clearly designated. They should be located so that queues do not obstruct main circulation routes.

2.2.3 Passageways

(a) Clearance dimensions for all interior travel passageways should be as follows:

minimum overhead clearance	1980 mm
minimum clearance width	1500 mm

Side protrusions shall not reduce the minimum clearance width. Anything that protrudes more than 100 mm from a passageway wall must have leading edges mounted at or below 650 mm above the finished floor. Where possible, wall mounted objects should be recessed rather than projected.

These recommended dimensions are based on the long-cane travel-clearance dimensions. However, many low-vision people may rely on their residual vision rather than on a cane. For these individuals, any protrusions, even those less than 100 mm, may pose a travel concern. Therefore, it is preferable that there not be any projections into travel passageways. If projections of less than 100 mm are unavoidable, they should be colour/brightness contrasted so as to be more visually discernible for some low-vision travellers.

(b) All stairs opening into a passageway must be preceded by the detectable warning surface described in 2.2.5. It is preferable that vertical level changes (i.e. stairs or ramps) be located out of the direct walkway or corridor route.

2.2.4 Emergency Exits/Alarm Systems

(a) The decibel rating for ease of recognition of audible alarms by visually impaired persons who do not have a hearing impairment is 90-98 decibels at 3 metres (14). However, in order to alert individuals properly, the audible emergency alarms should produce a sound that exceeds by 15 decibels the equivalent ambient sound level in the area, or exceeds by 5 decibels any maximum sound level with a duration of 30 seconds, whichever is louder. The alarm shall in no case exceed 120 decibels (15). The alarm should be intermittent in order to assist with sound localization and to allow individuals to utilize other auditory cues that may be present.

The alarm needs to be loud enough to alert the visually impaired person to an emergency situation and, at the same time, not be excessively loud so as to disorient and mask other audible cues used for orientation and egress.

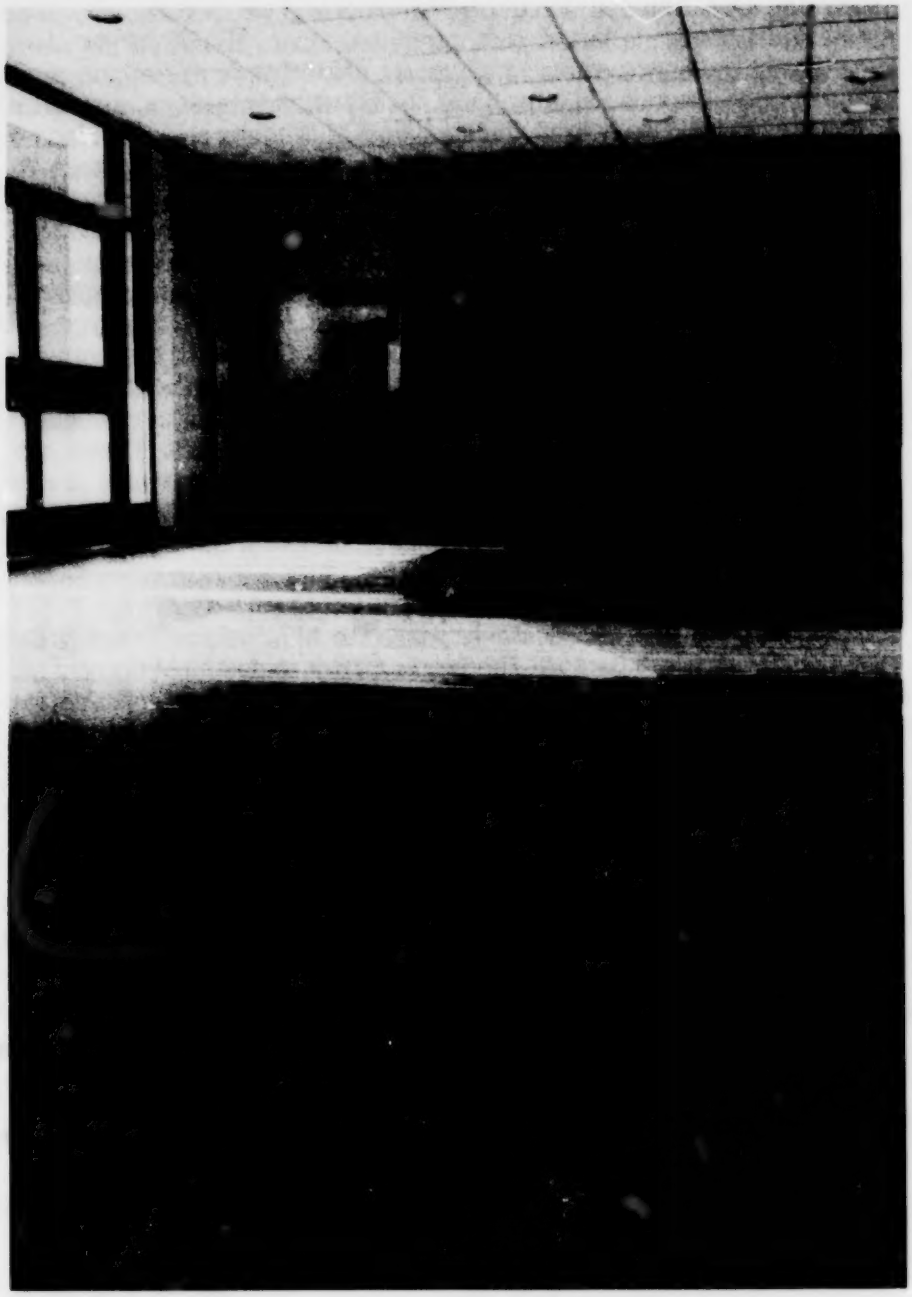


Figure 3 Textured light-coloured linoleum set into a dark-coloured carpet area is used to define main circulation routes in a building

(b) The placement of an alarm must be such that visually impaired persons can localize the sound through audible and visual cues, and effectively navigate the route to the emergency exit door. Therefore the alarm, audible-signal appliance should be placed immediately above the emergency exit door. Because in large buildings more audible-signal appliances than exit doors would likely exist, the additional appliances should be located so that they form an audible pathway to the emergency exit door. The appliances could be placed in the ceilings of corridors, foyers, rooms, etc. if an exit door did not exist within the immediate vicinity.

(c) All signage on the emergency exit door should comply with recommendations in section 2.2.7.

(d) In order to assist with egress, staff should be well trained in emergency procedures and the emergency escape routes should be clearly indicated on relevant orientation aids as described in 2.2.8. These aids, tactile/large print maps and/or audio maps, could be made available at information booth/check-in counters. All such maps should clearly indicate emergency exit routes and provide information concerning egress during an emergency.

(e) A clear and accessible approach to an emergency exit is vital for the visually impaired person. Therefore, all exit routes must comply with the clearance dimensions for safe unobstructed travel given in 2.2.3 (a).

(f) All illumination should comply with 1.5.1 (b). To assist with adaptation concerns, the lighting level should be consistent within 50 metres of the exit door. This is especially important for effective nighttime egress.

(g) In order to facilitate identification by visually impaired persons, the exit door should be painted in a colour/brightness contrast from the surrounding wall. The colour for emergency exit doors should be consistent throughout the building and different from other door colours in the building.

(h) The visually impaired person not only must locate the exit route/doorway after hearing the alarm but also be able to exit the doorway safely. A clear path [see 2.2.3 (a)] of 50 metres beyond the doorway is desirable. Should there be any barriers or obstacles within the path of travel, colour/brightness contrast and lighting cues should be used. The area immediately beyond the doorway should not have any sudden elevation changes, e.g. steps. All stairs must be properly marked by the detectable warning surface as outlined in 2.2.5.

2.2.5 Detectable Warning Surfaces

The detectable warning surface selected should be installed throughout a building as far as possible in a single application rather than being installed piecemeal over a period of time.

(a) The detectable warning surface must be easily detected by visually impaired persons who may be utilizing one or more of a wide variety of mobility systems, e.g. residual vision, the long cane, guide dog. Therefore the surface must be able to provide cues for each individual's travel mode. The detectable warning surface must consistently present detectable differences in resiliency, texture, colour/brightness contrast, and audition in order to be discernible to a maximum number of visually impaired persons. The textural difference must be of such a degree that it can be easily detected under foot or under the long cane tip.

(b) All detectable warning surfaces in a building must be consistent in: placement, materials utilized, and the warning message they convey to visually impaired persons.

(c) There should not be any flooring material utilized in a building which could be confused with the detectable warning surface.

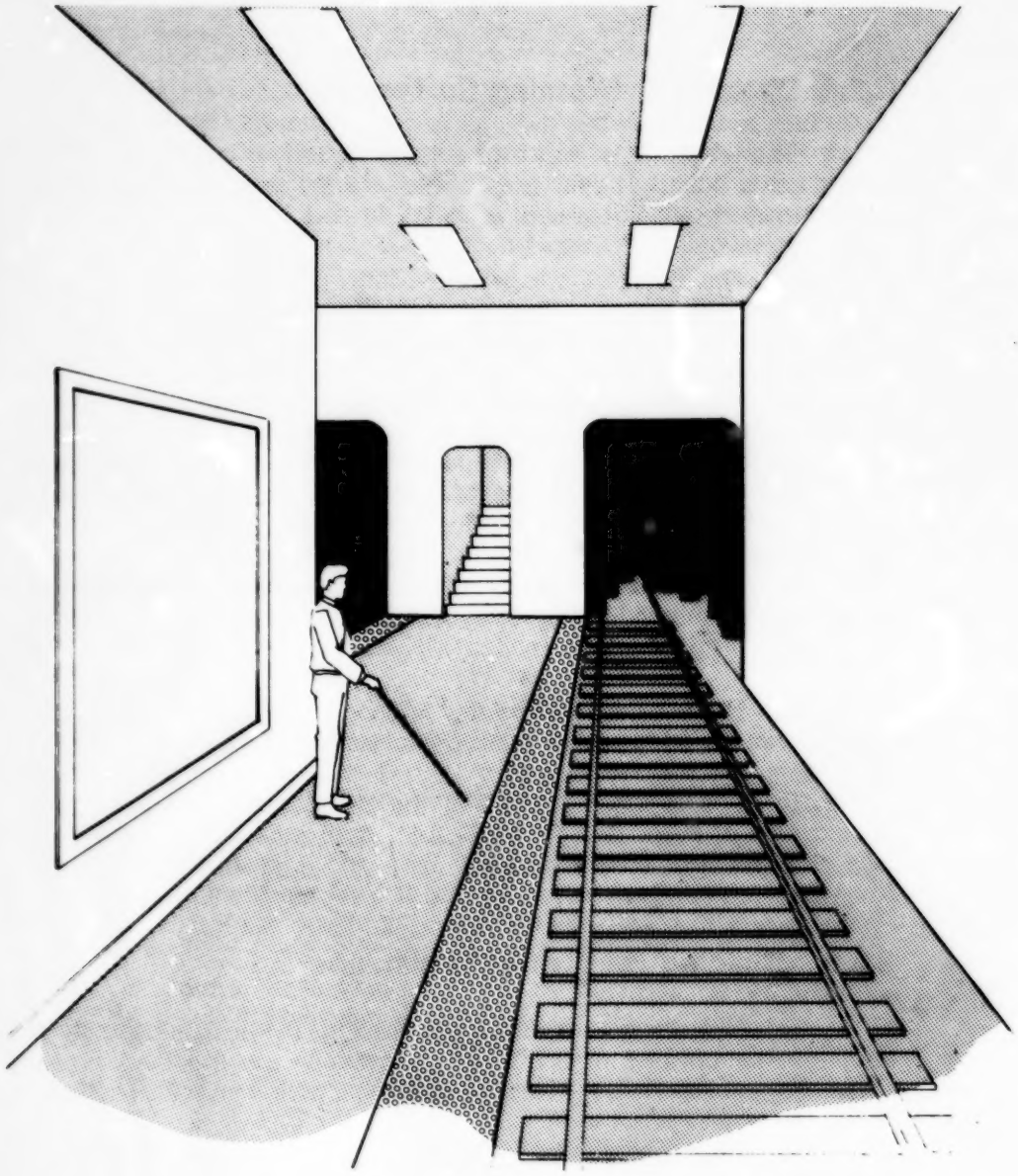
(d) It is recommended that the detectable warning surface be utilized only at stairs (2.2.16 and 2.3.5), curb cuts (2.3.4), and elevated platforms (2.2.18). (See Figure 4.)

2.2.6 Building Hardware/Furnishings

(a) All building hardware and furnishings in travel paths should meet requirements outlined in 2.2.3 (a). Necessary wall-mounted equipment should be recessed into the wall rather than projected from the wall surface.

(b) All furniture should be of colour/brightness contrast to its surrounding area. It is preferable that furniture be of a design that minimizes sharp uncovered corners. Furniture should be positioned out of the main walkway area.

(c) Furnishings and equipment should be of a low, light-reflective nature in order to minimize glare. Furnishings and equipment, such as taps, light switches, or paper-towel dispensers, should be consistently positioned throughout the building and should be of standard design and colour so they are easy to locate and recognize through touch.



The detectable warning surface should be positioned parallel to the open platform edge. It should extend for the full length of the platform and it should maintain a depth of 61 cm from the open edge of the platform. (San Francisco Bay Area Rapid Transit District specification for elevated platform detectable warning surface tile)

Figure 4 Proposed detectable warning surface on an elevated platform

(d) Where public telephones are equipped with cane detectable side panels, it is preferable that these panels be colour/brightness contrasted with surrounding surfaces and not be of a clear material. Telephone controls and directions for use should have an illumination level of at least 50 foot-candles. (One lux = 0.0929 foot-candles.) Telephones should have push button controls where service for such equipment is available.

2.2.7 Signage/Symbols

(a) The need for general orientation signage should be minimized by effective use of wayfinding and orientation principles in the building design.

(b) All signage should be consistently placed and of uniform design so as to be easily located and accessible.

i. All signage should have characters with a stroke width-to-height ratio between 1:6 and 1:10, utilizing an upper case "X" for measurement, and a character width-to-height ratio between 3:5 and 1:1. (Use an upper case 'X' for measurement). Only Arabic numerals and sans-serif upper case letters should be used.

ii. All signage should have a glare-free matte surface. The colour/brightness contrast between the character colour and the background colour should be at least 70 percent based on the formula presented in 1.5.1 (a), recommendation vii.

It is preferable that light characters on dark backgrounds be utilized (16). It is preferable that the sign background also be colour/brightness contrasted to the surrounding surface area.

iii. Illumination for signage must be shadow and glare free and in compliance with recommendations contained in 1.5.1 (b). Illumination for the sign panel itself should be a minimum of 10 foot candles (17).

iv. The size and intended viewing distance of general orientation and specific information signage should comply with the table below (18).

Dimensions for Print Height and Distance on Signage

Minimum Print Size	Maximum Viewing Distance	Use of Information
203 mm	610 cm	Station Entrances
152 mm	457 cm	Station Name, line name (from train and from station entrance)
100 mm	254 cm	Train name (viewed from platform)
76 mm	228 cm	Line transfer information inside station
51 mm	152 cm	Route information on display maps
25 mm	76 cm	Doors/rooms

v. Signage for general information and orientation should be consistently placed at key decision making points. It should be located well above head level in heavy pedestrian traffic areas so as to increase visibility in crowded conditions. The clearance dimensions cited in 2.2.3 shall apply.

vi. Doors and openings that lead from public places, and through which the public is permitted to pass, shall be identified by specific tactile information signage. Markings should be in sans-serif, upper case characters and/or Arabic numerals raised 1 mm with a high, stroke width-to-height ratio to facilitate reading by touch. Letters or numbers shall be at least 16 mm high but no higher than 51 mm.

vii. It is preferable that placement of signage for doors be on the wall to the right of the door. Signage should be consistently located 1350 mm $\pm$ 3 mm above the finished floor and not more than 150 mm from the door jamb.

viii. Enclosed stairwells shall have specific information signage to designate each floor. Such signage shall consist of Arabic numerals indicating the floor number and shall be permanently mounted on the stairway side of the wall, preferably to the right of the door. Placement dimensions for this signage should be consistent with 2.2.7(b) vii; signage dimensions should be consistent with 2.2.7(b) vi.

ix. Symbols and pictograms should be supplemented with print information.

(c) Large print materials should be presented in 18 point sans serif type (National Association for the Visually Handicapped, Large Print Standards). It is preferable that light characters on dark backgrounds be used.

(d) Braille signage should be presented in grade 2 braille with a format and code that meets the Standards outlined by the Braille Association of North America.

(e) Information signage should not be of the video display format where the information is rapidly scrolled across the video monitor screen. This type of signage usually changes messages so frequently that most low-vision travellers would encounter difficulties in attempting to visually fixate on the words long enough to read the signage.

2.2.8 Orientation Aids

(a) Where there is not a staffed information desk near each accessible main entrance, there should be an information telephone placed adjacent to the entrance. The telephone should be staffed by informed personnel who can provide appropriate orientation or other general information assistance to visually impaired persons and other travellers in need of assistance. The telephone should be in a consistent location throughout the setting and be of a consistent colour which is colour/brightness contrasted from the surrounding area.

(b) It is preferable that copies of portable maps be made available to visually impaired travellers in both the tactile/large print mode and the audio mode. In order to ensure usability these maps should conform to design principles outlined in the literature and be designed using input of the local consultation team.

2.2.9 Information Access

The wayfinding principles and the accessible design features incorporating appropriate sensory cues should be implemented in all terminal settings. By doing this, visually impaired individuals will be consistently afforded access to information necessary for orientation purposes.

(a) All relevant signage and print materials should meet recommendations outlined in 2.2.7.

(b) Where monitors are present to provide travel information e.g. arrivals, departures, there should also be present at least one monitor equipped with a non-glare screen that is located 1350 mm ± 3 mm above the finished floor surface. This monitor should be located in such a manner that visually impaired print users can position themselves within a few inches of the screen in order to read the print if necessary. The screen should be a high resolution type and the system should provide for black-on-white or white-on-black images (reverse polarity). It is preferable that the monitor also be equipped with speech and large print access. Placement and location of such monitors should be consistent throughout the setting.

(c) Public address systems should be of a sound quality that is clearly discernible above ambient noise in the setting.

(d) Emergency information available in print should be made available in large print, audio tape and braille. It is preferable that other general information such as schedules, fare and gate information also be made available in these modes, particularly if such information is not available in advance via telephone.

(e) Where staffed information desks are not immediately adjacent to main accessible entrances, it is preferable that there be an information telephone system staffed by trained and informed personnel set up in a consistent location adjacent to the main accessible entrances.

(f) It is preferable that orientation aids as recommended in 2.2.8 be made available.

(g) It is preferable that a closed circuit television (CCTV) system to assist low-vision individuals to read print material be made available at the main information access points.

(h) One of the most important elements for ensuring information access by visually impaired persons is the presence of trained, knowledgeable and caring service personnel who are readily available to offer reasonable assistance upon request.

2.2.10 Queuing/Line-ups

(a) All queue areas should be clearly designated. They should be located so that queues do not obstruct main circulation routes.

(b) It is preferable that suspended queue guides not be utilized. Where they are in existence, they should meet all cane clearance dimensions outlined in 2.2.3 (a), and be in colour/brightness contrast to the surrounding flooring.

2.2.11 Counters

(a) Counter surfaces should be cane detectable and colour/brightness contrasted from the surrounding surface.

(b) Counter surfaces should have a non-glare, matte finish.

(c) Where a glass partition separates customers from service personnel, there should be an adequate speaker system in place to facilitate verbal communication between both parties and to assist a visually impaired person to localize the origin of the speaker's voice.

2.2.12 Floors

(a) Floor surfaces should have a non-glare, matte finish.

(b) The floor surface in large open areas should provide orientation cues for main circulation routes by differing in resiliency, colour/brightness contrast, texture and audition. (See 2.2.2.)

(c) To avoid possible figure ground and depth perception difficulties, it is preferable that the use of heavily patterned floor surfaces be minimized especially in areas where there are elevation changes. (See 2.2.16.)

2.2.13 Doors

(a) Doors to hazardous rooms should incorporate appropriate warning signage in compliance with 2.2.7 and should be kept locked.

(b) There should not be any rough texture, such as knurling, applied to door handles. At present there is conflict in the guidelines concerning textured door handles; hence, there is potential for dangerous misinformation to visually impaired persons.

NOTE: Contradictions are present in existing building codes and standards regarding the roughening of door handles. The British Columbia Building Code and The American National Standard for Buildings and Facilities (ANSI) contradict one another regarding the application of a rough texture on door handles. The B.C. Building Code Section 3.7 recommends the texturing of door handles to indicate exits. The ANSI standard recommends the texturing of door handles to warn of a hazardous area.

(c) Where double doors are used, in order to assist access by guide dog users, it is preferable that both door leafs be unlocked and functioning during operating hours.

(d) Doors should be installed so that they open with the main flow of pedestrian traffic and do not open outwards into busy passageways. (See Figure 5.) When closing, swing doors should not swing beyond the normally closed position.

(e) It is preferable that automatic doors slide open parallel with the wall rather than swing open toward or away from the pedestrian line-of-travel.

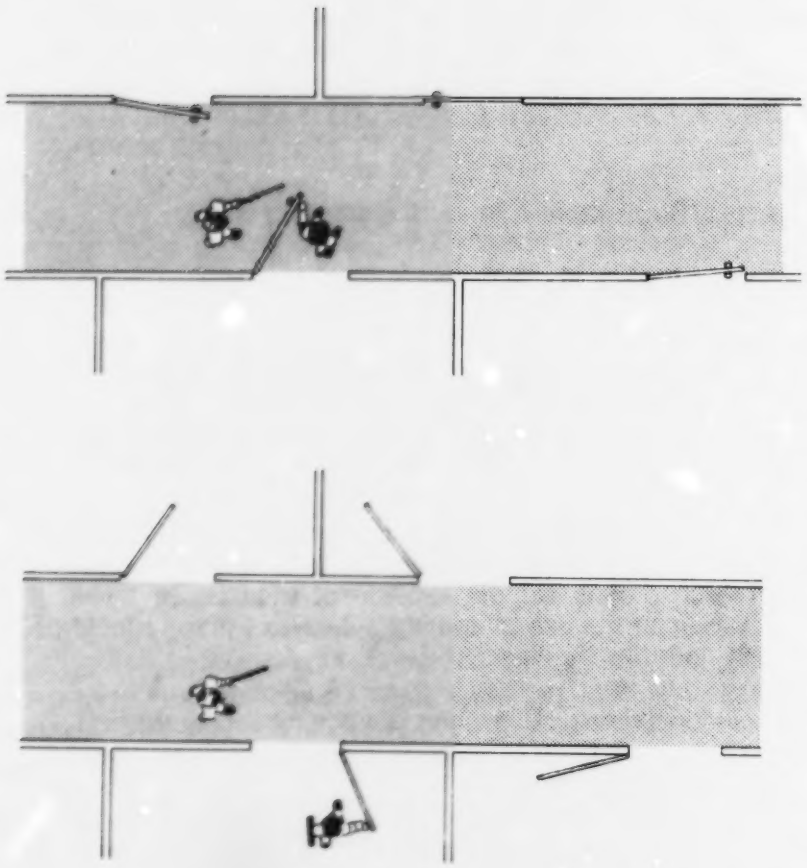
(f) Doors and door frames should be colour/brightness contrasted from their surrounding surfaces. Door handles should be colour/brightness contrasted from the door surface.

(g) Automatic entry/exits that employ a door which swings toward or away from the pedestrian line-of-travel should have: guard rails, power floor mats extending for the full swing area of the door, horizontal or vertical sensing devices, and doors that remain fully open until the area is cleared by the user.

(h) Signage for doors should comply with the recommendations in section 2.2.7.

(i) In doorways where thresholds are not flush with the floor, the difference in level shall not exceed 13 mm and shall be beveled. The elevated area should be colour/brightness contrasted from its surrounding surface.

(j) It is preferable that doors not be made completely of glass. Where such doors currently exist, they should have colour/brightness contrasted markings, a minimum of 130 mm in width, applied horizontally across the full door surface 1350 mm $\pm$ 3 mm above the finished floor.



Doors should not open outwards into passageways (top). A safer installation is shown in the second drawing.

Figure 5 Doors

(k) It is preferable that doors be equipped with self-closing devices, particularly in the case of doors opening into busy pedestrian circulation routes. When left open, a door should be flush against a wall rather than partially open.

(l) Automatic revolving doors should not be used. The design of such doors makes them very difficult for a visually impaired person to detect in some cases. The doors themselves can prove to be a hazard to a visually impaired traveller.

2.2.14 Windows/Skylights

(a) All windows and skylights should meet with recommendations in 1.5.1 (b).

(b) Windows and skylights are natural illumination sources which can be hard to direct and control. They should be carefully designed and adapted so they do not create glare problems for visually impaired individuals.

(c) The amount of natural light entering a window or skylight should be controlled. A more consistent presentation of natural light can be ensured through such means as: the location of windows, the use of diffusers and/or tints, and the use of awnings. Backup lighting should be used for night and dark day illumination.

(d) All windows should be designed so that they meet recommendations for clearance dimensions as outlined in 2.2.3.

(e) It is preferable that there not be large expanses of interior windows utilized to divide rooms or serve as general partitions. Where these are in existence they should have colour/brightness contrasted markings, a minimum of 130 mm in width, applied horizontally across the full window surface 1350 mm $\pm$ 3 mm above the finished floor.

2.2.15 Walls

(a) All wall surfaces and fixtures should meet recommendations for clearance dimensions outlined in 2.2.3.

(b) Different wall colour schemes paired with textural surfaces may be used consistently throughout a setting to signify specific areas within

the terminal, e.g. exit routes, entrances for concessions, restaurants, cafeterias, washrooms. These consistent visual and tactile cues can assist a visually impaired individual with orientation.

(c) Materials utilized in the design of walls should take into consideration the acoustical requirements of the setting. Design of walls should follow the recommendations found in 1.5.2.

(d) Wall and floor surfaces should be colour/brightness contrasted from one another.

(e) It is preferable that wall surfaces not be designed entirely of mirrored or glass surfaces. Where these are in existence they should have colour/brightness contrasted markings, a minimum of 130 mm in width applied horizontally across the full wall surface 1350 mm ± 3 mm above the finished floor.

(f) It is preferable that walls have a matte finish and that they not have extremely rough or uneven surface qualities which could be uncomfortable to touch.

2.2.16 Stairs

(a) The approach to a stairway is very important to visually impaired travellers. The stairway should not be in an unexpected location. All stairways should be consistently positioned and clearly marked with a detectable warning surface. It is preferable that stairs be located out of direct pedestrian circulation routes.

(b) The onset of all stairs, whether enclosed or in open areas, should be preceded by a consistent, detectable warning surface; see 2.2.5. Pending further research validation it is proposed that the detectable warning surface extend the full width of the stair, maintain a depth of 762 mm and commence one tread depth back from the front edge of the stair. Where there are flights of stairs the detectable warning surface shall be present at the commencement of each stair flight that has a pedestrian entrance.

(c) When retrofitting existing buildings, it is preferable that the installation of detectable warning surfaces occur on all stairs as nearly as possible within the same time period for a given building. Installations should not be made piecemeal because of the risk of creating confusion for visually impaired travellers.

(d) In order to allow for adequate warning to visually impaired travellers where a doorway opens to a stairway, the stairway should be preceded by a level area of at least the same dimensions as a standard stairway landing.

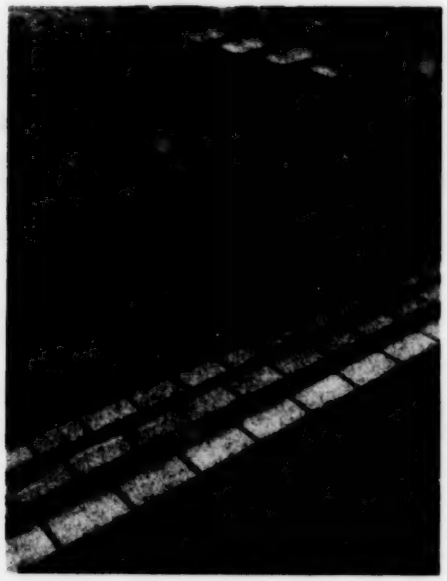
(e) All stair risers must be of consistent dimension and design throughout a stair system and preferably throughout a building complex. Risers shall be a maximum of 180 mm in height and be sloped or provided with a nosing, the underside of which has an angle of not less than 60 degrees from the horizontal (15).

(f) Stair treads should be of a uniform and consistent depth, not less than 280 mm and not more than 355 mm including the dimension of the nosing. Stair treads must have a uniform depth throughout a stair system and preferably throughout a building complex. Stair treads should be finished with a slip-resistant, glare-free matte surface.

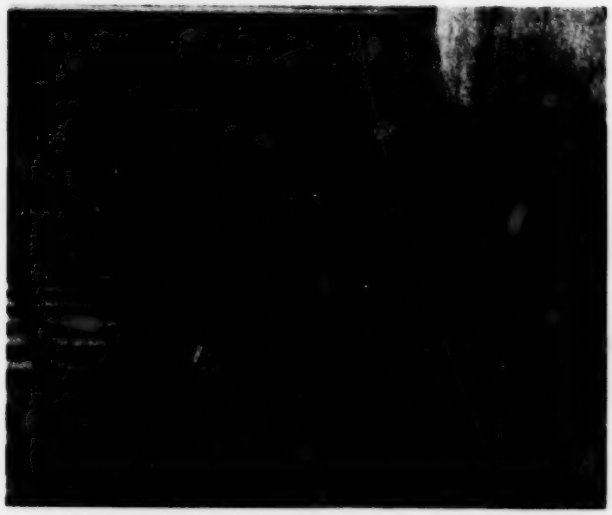
(g) There is no need to project stair-tread nosings on stairs that have proper tread depth. Where used, stair-tread nosings should project no more than 25 mm beyond the associated risers and should extend horizontally onto the tread surface a minimum of 25 mm. The nosings should extend vertically no more than 1 mm above the tread or landing surface. The nosings should be constructed of a slip-resistant surface (not smoothly finished metal, plastic, wood, etc.). Nosings, or where nosings are not used the leading horizontal surface of each tread, should incorporate a colour/brightness contrast factor with the associated riser and tread. They should be clearly visible from the top and bottom of stairways. (See Figure 6.) Nosings should not incorporate sharp design configurations either on the top of the tread surface or the underside and should have a radius of curvature at the leading edge of the tread of not more than 12 mm. The tread surface should be of a dark colour with a lighter colour utilized for the nosing.

(h) Carpeted stairs should incorporate slip-resistant, colour/brightness-contrasted nosings. Only tight-weave, low-pile carpeting should be used on stairs. It should be firmly attached and be kept in good repair. It is preferable that heavily patterned carpet designs, especially designs incorporating stripes, not be utilized on stairs. Such designs can cause figure-ground concerns for the low-vision traveller thus interfering with the visual identification of the tread nosing and creating undue difficulties with depth-perception judgments. Remember, figure ground confusion can arise from any heavily patterned surface, e.g. terrazzo, stone.

A stair system with three steps: the terrazzo brick pattern and lack of any contrasting nosings completely obscure the stairs



A similar stair system that is much more visible due to the contrasted nosings



Another example of the high visibility created by contrasted nosings

Figure 6 Stairs

(i) Landings should be of standard width. It is preferable that doorways opening onto landings be located consistently on the wall opposite to the open stairway. This placement helps a visually impaired person to approach the stairway at a 90-degree angle.

(j) All stairways should incorporate closed stringers.

(k) It is preferable that handrails exist on both sides of the stairway. In order to meet clearance dimensions for cane detectability, the ends of the handrail should return smoothly to the wall or floor. All handrails should be colour/brightness contrasted from their surrounding surfaces.

(l) Hand rails to stairs shall extend at the top to a minimum of 300 mm beyond the top riser parallel to the floor or ground surface; and at the bottom continue to slope one tread depth beyond the bottom tread and then a further 300 mm horizontally beyond, except where the handrail is continuous.

(m) Handrails should be graspable along their entire length. The thumb and fingers should be able to curl around and under the handrail to achieve a secure grip. For adults, this requires a circular, oval or rectangular section with maximum dimensions in the horizontal orientation. This dimension should be less than 50 mm, preferably 35 mm.

(n) Where ramps and stairs are located adjacent to one another, there should be at least a handrail clearly dividing the two structures. The presence of the handrail prevents a visually impaired person from accidentally stepping off the side of the stairway onto the ramp.

(o) The illumination level in stairway areas should be glare free and consistent with the illumination level in the remainder of the building [see 1.5.1 (b)]. Due to the critical nature of stairs, they should be provided with alternative emergency lighting so that if the main source of lighting fails a second source will continue to provide light (19).

(p) Landings, treads, and nosings shall be stable, firm, slip-resistant and free of debris that could present a hazard.

(q) Winding and spiral staircases constructed with tread surfaces that vary in width are not recommended.

(r) The use of free-standing or cantilevered staircases should be avoided. Such designs present a non-cane detectable hazard to visually impaired travellers. The undersides of such stairways should be enclosed

through original design or by the placement of cane-detectable landscaping or furnishings to prevent access to the overhang area. (See Figure 7.)

(s) All signage to designate floors in enclosed stairwells shall comply with recommendations in 2.2.7.

2.2.17 Ramps

(a) Handrails for ramps should be consistent with handrails outlined for stairs. (See 2.2.16.)

(b) Where ramps and stairs are located adjacent to one another, there should be at least a handrail clearly dividing the two structures. The presence of the handrail prevents a visually impaired person from accidentally stepping off the side of the stairway onto the ramp.

(c) It is preferable that ramp surfaces have a colour/brightness contrast factor as well as a tactile surface difference from the surrounding area.

(d) The illumination level for ramps should comply with recommendations found in 1.5.1 (b). Ramps should have alternative emergency lighting so that if the main source of lighting fails a second source will continue to provide light.

2.2.18 Elevated Platforms

(a) Illumination for areas with elevated platforms should meet with recommendations in 1.5.1 (b).

(b) Elevated platform edges should be marked with detectable warning surface material as outlined in 2.2.5.

(c) The detectable warning surface should be positioned parallel to the open platform edge. It should extend for the full length of the platform; and it should maintain a depth of 61 cm flush from the open edge of the platform.

(d) The detectable warning surface utilized should be consistent in material and placement throughout the setting.

(e) When retrofitting existing buildings it is preferable that the installation of detectable warning surfaces occur on all open platforms as nearly as possible within the same time period for a given building. Installations should not be made piecemeal because of the risk of creating confusion for visually impaired travellers.

(f) All parts of the elevated platform that are accessible by travellers must meet recommendations for clearance dimensions as outlined in 2.2.3.

2.2.19 Escalators

(a) The back of all escalators should be enclosed. Escalators with open backs present a non-cane detectable hazard to visually impaired travellers. The back of the escalators can be enclosed through original design or by placement of fixed, cane-detectable landscaping or furnishings to prevent access to the overhang area.

(b) Escalator platforms should extend a minimum of 600 mm from the onset of the escalator in order to provide adequate warning of its presence to visually impaired persons.

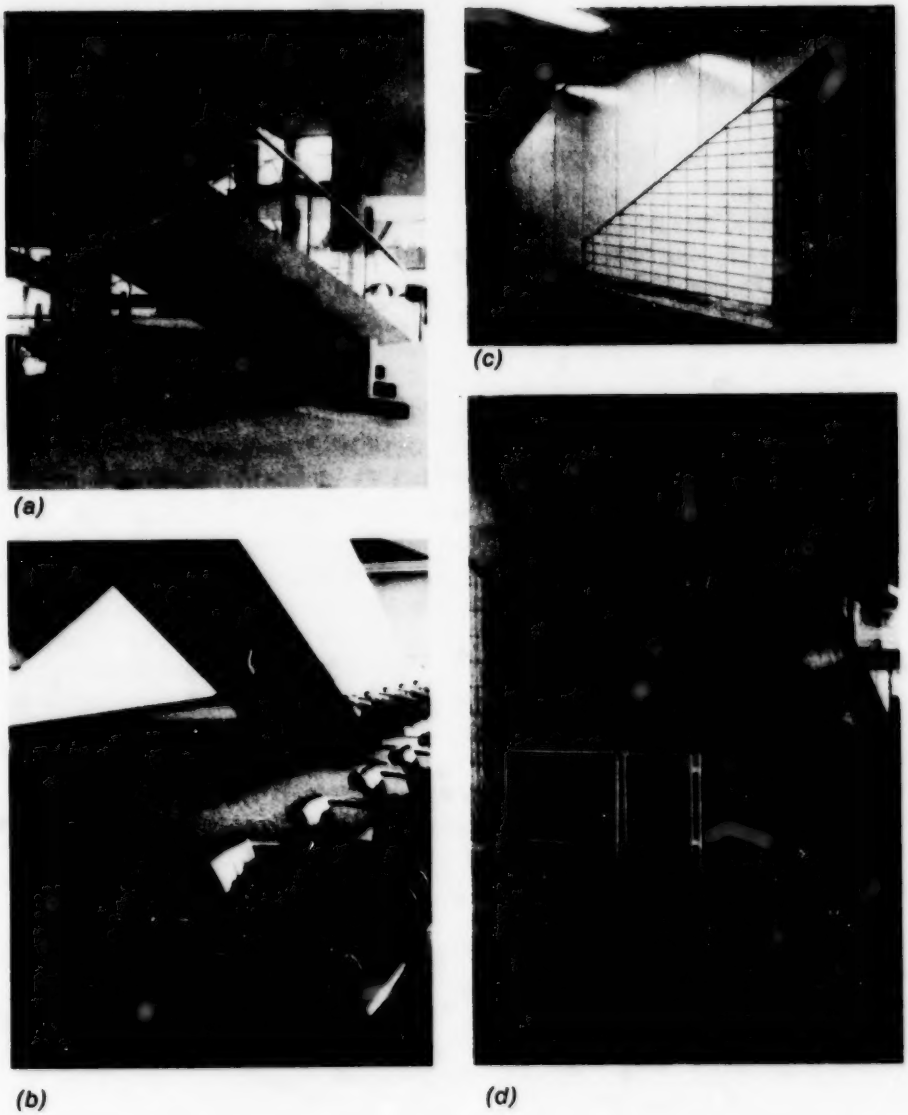
(c) Escalators should have general information signage indicating their presence and their direction of travel. All signage should comply with section 2.2.7.

(d) Escalators under repair should have signage indicating that they are out of order. The landings for the escalator should have an appropriate barricade (see 2.2.25) to prevent public access.

(e) The escalator tread should be painted a minimum of 25 mm from the escalator step edge with a coating that incorporates a colour/brightness contrast from the surrounding tread surface. Where escalators may reverse direction of travel, both the tread and the riser should be painted a minimum of 25 mm from the escalator step edge.

(f) Illumination for the escalator and surrounding area should comply with 1.5.1 (b).

(g) It is preferable that the escalator surface be constructed of low-reflective, non-glare material with a matte finish.



(a) and (b) illustrate open back stairways that are not cane detectable; (c) and (d) illustrate modifications that can make such areas safer travel environments for visually impaired persons. Seating arrangements, landscaping or other more esthetically pleasing adaptations rather than the gate shown in (d) can also be used to create a cane detectable barrier

Figure 7 Open back stairways

(h) It is preferable that a stairway or other means of vertical access be positioned next to the escalator to assist guide dog users whose guide dogs are not trained to use escalators.

2.2.20 Moving Walkways

(a) The back of all inclined, moving walkways should be enclosed. Walkways with open backs present a non-cane detectable hazard to visually impaired travellers. The back of the walkways can be enclosed through original design or by placement of fixed cane-detectable landscaping or furnishings to prevent access to the overhang area.

(b) Walkway platforms should extend a minimum of 61 cm from the onset of the walkway in order to provide adequate warning of its presence to visually impaired persons.

(c) Walkways should have general information signage indicating their presence and their direction of travel. All signage should comply with section 2.2.7.

(d) Walkways under repair should have signage indicating that they are out of order. Entrances and exits of walkways should have an appropriate barricade to prevent public access. (See 2.2.25.)

(e) There should be a minimum 25 mm width marking, colour/brightness contrasted from the surrounding area located across the full width of the platform edge to indicate the onset and exit of the moving walkway surface.

(f) Illumination for the walkway and surrounding area should comply with recommendations in 1.5.1 (b).

(g) It is preferable that the walkway surface be constructed of low reflective, non-glare material with a matte finish.

2.2.21 Elevators

(a) The elevator car operating panel shall be marked with tactual markings immediately to the left of the car control buttons. Markings should be symbols and/or Arabic numerals or sans-serif letters. The markings should be colour/brightness contrasted to their background surface. As some congenitally blind persons do not know print letters or Arabic

numerals, it is preferable that elevator control buttons be marked with braille as well. It is preferable that the braille be positioned to the left of the raised symbol, numeral or letter. All raised markings and other signage should be in compliance with dimensions outlined in 2.2.7.

(b) Control buttons such as door open, door close, emergency controls, and other essential identifications should be located below floor number controls. There should be a star symbol to the left of the main entry floor button.

(c) Heat sensitive control buttons should not be used on the elevator car operating panel.

(d) Floor designations at each hoistway entrance on each jamb should be indicated by tactile Arabic numerals and/or upper case sans serif letters. Markings should be a minimum 38 mm high, raised 1 mm, and centered 1524 mm above the finished floor.

(e) The elevator car operating panel should be equipped with floor registration buttons that visually register each call and extinguish when the call is answered. Buttons should have a minimum dimension of 19 mm, and be raised, flush, or recessed with depth of flush or recessed buttons, when operated, not to exceed 9 mm (12).

(f) The elevator car should be equipped with a visual car position indicator to show the position of the car in the hoistway by illumination of a marking corresponding to the landing at which the car is stopped or passing. The indicator should use minimum 16 mm high characters on a colour/ brightness contrasted background.

(g) The elevator should have re-opening activators located 125 mm $\pm$ 25 mm and 740 mm $\pm$ 25 mm above the finished floor, or other acceptable detector system on automatic doors that automatically reopens the doors fully, or stops the doors, without having to make contact if a person or object passes through the doorway. Doors should remain fully open a minimum of 3 seconds in response to a hall call.

(h) The elevator should have a two-way automatic maintaining leveling device to level the car to within $\pm$ 12 mm of the hall floor.

(i) The elevator car should have an emergency communication system which is colour/brightness contrasted from the surrounding surface.

The system should be identified with the international symbols for telephones with the symbols being minimum 38 mm high and raised a minimum 1 mm. Other acceptable two-way emergency communication systems may also be used.

(j) The illumination level within the elevator's interior should be consistent with illumination levels throughout the building and comply with 1.5.1 (b). Doors and the interior of the elevator should be of a non-glare matte finish and should not present a mirrored surface.

(k) Elevators should have an audible cue not less than 24 decibels that sounds as each floor level is passed. There should also be an audible signal when an elevator stops at a landing; a tone which identifies the direction of travel, or an acceptable verbal annunciator.

2.2.22 Washrooms

(a) Illumination levels in washrooms should be consistent with recommendations in 1.5.1 (b).

(b) All signage for washrooms should be consistent with recommendations outlined in 2.2.7.

(c) Washroom doors and walls should be consistent with recommendations outlined in 2.2.13 and 2.2.15.

(d) The entry vestibule, washroom, and interior of water closets should meet all clearance dimensions as outlined in 2.2.3.

(e) Vestibules for the entryway to washrooms often present a myriad of configurations within a given building complex. It is desirable that where a vestibule precedes entry to a washroom, the vestibule design be simple and straightforward in design. Consistent design should be used throughout the building for all washrooms, entry vestibules, and fixtures within the washroom area.

(f) It is desirable that water closet enclosures be colour/brightness contrasted from their surrounding surfaces by a minimum factor of 70 percent.

(g) Where exposed heating or hot water pipes are accessible to persons using the facilities, such pipes should be insulated so they do not constitute a burn hazard to a visually impaired person trailing the wall surfaces.

(h) Accessories

i. All accessories in the main washroom area such as hand dryers, towel dispensers, waste receptacles, and vending machines should be centrally located and in close proximity to the wash basins.

ii. It is desirable that fixtures, such as wash basins, towel dispensers, hand dryers, soap dispensers, urinals, toilets and vending machines, be colour/brightness contrasted from their surrounding surfaces.

iii. There should not be any projections over the wash basins, e.g. lighting fixtures, soap dispensers, towel dispensers, which could constitute a hazard when a person is bending over the wash basin.

iv. Faucets and taps should be of a consistent design and should not have spring-loaded turning handles. Water temperatures at such fixtures should be controlled to assist persons with limited sensation in their hands.

v. It is preferable that urinals be floor mounted rather than wall mounted. Wall mounted urinals should meet with all clearance dimensions outlined in 2.2.3.

vi. The toilet or urinal should have accessible hand-operated flushing controls. Foot pedal controls are not acceptable.

2.2.23 Cafeterias/Restaurants/Concessions

Food service areas such as cafeterias and restaurants are by their nature inconsistent in design and are not easily accessible or usable by the visually impaired population. Lighting levels, passageway width and food vending unit designs vary greatly.

Cafeterias present more of a challenge for visually impaired persons than restaurants. Not only must they locate a vacant table and chair but they also must locate the desired food, beverages, utensils and condiments.

(a) All signage, braille, and large print materials in the setting should follow recommendations outlined in 2.2.7. There should be appropriate signage for the exit, food service area, tray return area, cashier, washroom, and cloakroom.

(b) All areas should meet the clearance dimensions given in 2.2.3. The area immediately above the table setting should be clear and not encumbered by low-hanging, swag lamps, plants or other decorations at head level.

(c) Display items should be set away from the main service line. Utensils, such as plates and glassware, should be displayed so that they are secure and not easily displaced.

(d) Many restaurants have very low levels of lighting. For low-vision individuals it is especially important that the restaurant or food area have a sufficient level of illumination to be consistent with the main circulation areas of the terminal. Illumination throughout should follow recommendations in 1.5.1 (b).

(e) It is preferable that the use of turnstiles and posts with suspended queue guides for entrances and exits be discouraged. These features often are confusing and hinder the access of visually impaired persons using a sighted guide or a guide dog.

(f) Cafeteria entrances should provide an indication of path of travel to the start of the food serving line. In addition to appropriate signage, such a path of travel could be provided by using detectable floor surface differences — texture, resiliency, sound, and/or colour/brightness contrast (a light coloured tile could be used for the pathway and dark carpeting for the remaining area for example: or colour/brightness contrast of any walls leading into the food service area). There should be a clear unobstructed pathway through the food service area.

(g) Cafeterias should utilize clear simple design incorporating good wayfinding principles. Continuous counters to slide trays along are preferable to several separate counters or food service stations. Placement of food, utensils, and condiments should follow a logical sequence.

(h) All hot-food serving areas should be designed so that customers cannot inadvertently come in contact with hazardous heat sources.

(i) Where there are self-serve food areas in a cafeteria line-up with the food displayed behind enclosures, it is preferable that the contents of the enclosures be listed on the enclosure door in large print (18 point print, sans serif type) and braille.

(j) Large print and braille menus should be made available in advance of the food service queue area. Large print menus should be of at least 18 point print and of sans serif type with black print on white paper. The

surface of the print menu should be glare free and well illuminated. Braille menus should comply with 2.2.7. Such menus should be kept up to date both in content and pricing; and be posted on the wall in a consistent location by the restaurants or cafeterias throughout the terminal. Menus should be positioned 1350 mm ± 3 mm above the finished floor.

(k) Vending machines should have large print and braille labels, in compliance with 2.2.7, indicating contents, price and any pertinent directions.

(l) Chairs and tables should be colour/brightness contrasted from their surrounding areas.

(m) Entrances to concessions should be clearly defined by flooring surfaces that are detectable in their tactile difference and colour/brightness contrast factor from the main circulation route. To assist with tactile location of entrances from main circulation routes, the main route may be intersected with the different textured flooring surface to indicate an entryway into a concession area.

2.2.24 Baggage Claim Area

(a) Illumination for the baggage claim area should comply with recommendations contained in 1.5.1 (b).

(b) All signage for the baggage claim area should follow recommendations outlined in 2.2.7. It is particularly important that accessible signage pairing each conveyor with the appropriate flight number be made available. Clear signage should identify exits and connecting ground transportation locations.

(c) Clearance dimensions for the baggage claim area should follow recommendations outlined in 2.2.3.

(d) It is preferable that the main route to the baggage claim area utilize a differentiated tactile pathway paired with colour/brightness contrast.

(e) It is preferable that the baggage claim conveyor be colour/brightness contrasted from its surrounding area.

(f) Where there are monitors utilized at the baggage claim conveyor to indicate which conveyor is matched to a specific flight, there should be at least one monitor that is in compliance with recommendations given in 2.2.9.

2.2.25 Construction

(a) Construction areas should be closed to public entry.

(b) Properly designed barricades should be in place to prevent public entry into the construction site. These barricades should be cane detectable and colour/brightness contrasted from the surrounding area. (See Figure 8.)

(c) Walkways utilized by the public should be kept free of debris from the construction site.

(d) Clearance dimensions recommended in 2.2.3 should be complied with for all public walkways on the construction site. Particular attention should be given to bracing or supports used for scaffolding structures.

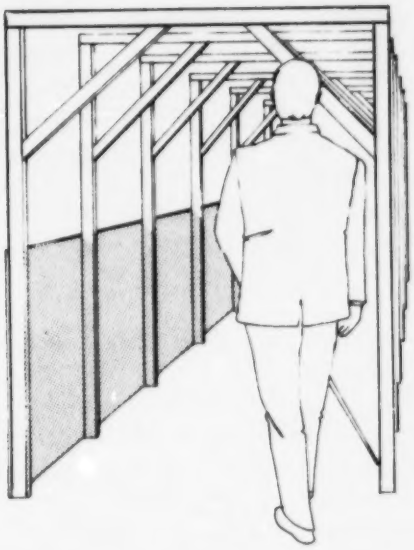
(e) Illumination levels throughout the construction site should comply with recommendations given in 1.5.1 (b).

(f) Signage should comply with 2.2.7 and should be placed in advance of the site to identify the presence of construction and to indicate rerouting of pedestrian traffic.

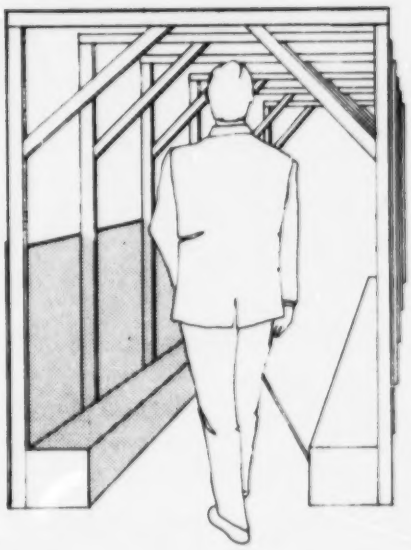
(g) Construction equipment left unattended, such as ladders, sanders, saws, etc., should be placed behind barricades and should not be present in the public throughway.

(h) The floor of the public throughway should be a consistent smooth surface. Elevated walkways should have handrails on both sides.

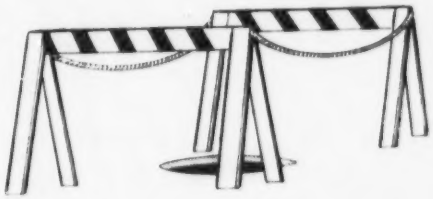
(i) All stairs and ramps should comply with recommendations outlined in 2.2.16 and 2.2.17.



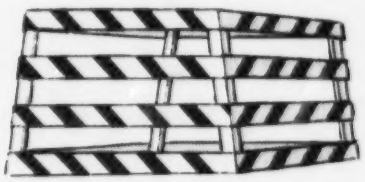
A poorly designed construction barrier that is not cane detectable



This modification to the barrier allows it to be detected by the long cane and thus prevents possible contact at head level by the visually impaired person



The common saw horse is not normally detected by the long cane



This barrier serves the same purpose as the saw horse but is cane detectable for visually impaired travellers

Figure 8 Construction considerations

2.3 EXTERIOR

2.3.1 Entrances

(a) Exterior entrance design should comply with the recommendations in 2.2.1.

2.3.2 Walkways

(a) Clearance dimensions for all exterior walkways are: minimum overhead clearance — 1980 mm; minimum clearance width — 1500 mm. The walkway must be free from obstruction for the full width of the walk except that handrails are permitted to project not more than 100 mm from either or both sides into the clear area.

(b) The surface of the walkway should be solid, smooth, level, and kept free of snow, ice and other debris.

(c) The walkway should have a minimum, 75 mm high upturned edge where the vertical drop from the walk exceeds 75 mm, and there are no walls, railings, or other barriers on either or both sides of the walk.

(d) The walkway should have a minimum, 1500 mm wide walk of a detectable difference in texture (under cane tip) to that surrounding it where the line of travel is level and even with adjacent walking surfaces.

(e) Illumination for all exterior walkways should comply with recommendations in 1.5.1 (b). In particular, floodlights should not be positioned so that they shine directly into a pedestrian's face.

(f) It is preferable that stairs be positioned so that the elevation change is not concealed from low-vision persons by shade or other sudden illumination changes.

(g) Guy-wires positioned near walkways should be enclosed with a bright yellow plasticized cover which encircles the guy-wire from the ground up to a minimum height of 1980 mm.

(h) All walkway areas should have curbs where that walkway is positioned beside vehicular routes. The only break in the curb surface should be for curb cuts as outlined in 2.3.4.

2.3.3 Islands

(a) Curbing for islands should follow recommendations for curbing and curb ramps outlined in 2.3.4.

(b) It is preferable that islands not be placed in the crosswalk area. Where such islands exist it is preferable that they be cut through level with the street.

2.3.4 Curb Ramps

(a) The placement of curb ramps should be consistent in location throughout the setting.

(b) Due to the difficulty of detection by most visually impaired travellers, blended curbs or wrap around curb ramps which cover the entire corner of an intersection should not be employed.

(c) It is preferable that curb ramps with flared sides be utilized as illustrated in Figure 9, and that the design utilized be consistent throughout the setting.

(d) The entire surface of the curb ramp, including the flared sides, shall have a detectable warning surface as outlined in 2.2.5.

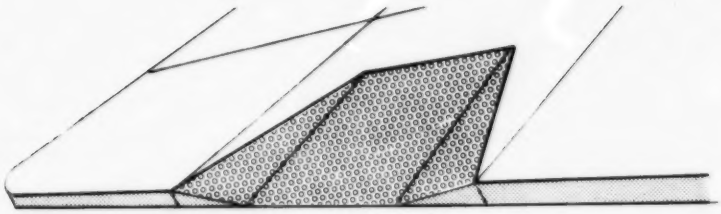
2.3.5 Stairs

All aspects of design for exterior stairs shall be consistent with recommendations in 2.2.16 and with the following recommendations.

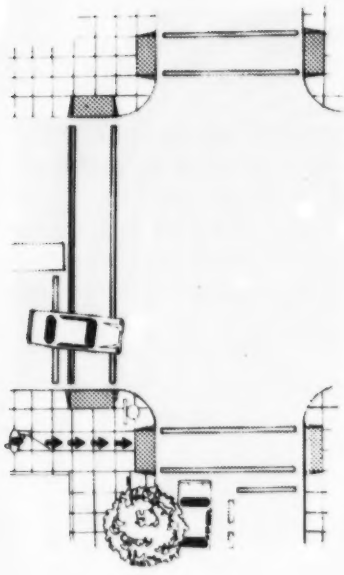
(a) The stairway system should be maintained free of snow and ice. If an exterior stairway cannot be covered, an appropriate sub-surface heating system could be considered as a means of keeping the stairway free of snow and ice.

(b) Construction of exterior stairs should consider drainage factors and the necessity to maintain the stair surface free of dirt and debris.

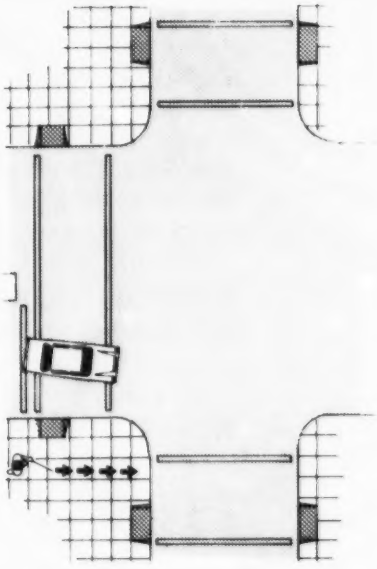
(c) Stair surfaces should consist of glare-free materials. Consistent illumination should be provided for evening travel. The artificial illumination of exterior ramps, at night, should meet requirements outlined in 1.5.1 (b).



The recommended flared curb ramp with the detectable warning surface



Placement of the curb ramp in the direct line of travel



Placement of the curb ramp outside of the direct line of travel yet still within the crosswalk area. The ramp illustrated is the preferred consistent placement for most visually impaired travellers; however, size of crosswalk and curbside obstacles do not always allow for this offset placement of the curb ramp

Figure 9 Curb ramp design and placement

The illumination should be positioned such that glare and shadows are minimized. All illumination systems, such as spotlights, should be directed onto the stair surface rather than directly into the individual's face.

2.3.6 Ramps

All aspects of design for exterior ramps shall be consistent with recommendations in 2.2.17 and with the recommendations given below.

(a) Ramp systems should be maintained free of snow and ice. If an exterior ramp cannot be covered, an appropriate sub-surface heating system could be considered as a means of keeping the ramp free of snow and ice.

(b) Construction of exterior ramps should consider drainage factors and the need to maintain the ramp surface free of dirt and debris.

(c) Ramp surfaces should consist of glare free materials. Consistent illumination should be provided for evening travel. The nighttime illumination of exterior ramps should meet requirements outlined in 1.5.1 (b). The illumination should be such that glare and shadows are minimized. All illumination systems, such as spotlights, should be directed onto the ramp surface rather than directly into the individual's face.

2.3.7 Landscaping

(a) Landscaping should comply with clearance dimensions specified in 2.2.3.

(b) It is preferable that thorny plants not be used immediately adjacent to walks (Illinois Accessibility Standards).

(c) It is preferable that plants that drop large seed pods not overhang, or be positioned near, public pathways (Illinois Accessibility Standards).

2.3.8 Gratings

(a) Gratings, manhole covers and other access covers should be placed outside walkways whenever possible. When circumstances require

their presence on walkways, gratings should have open spaces no greater than 13 mm in one direction. In order to minimize the incidence of cane tips catching in gratings, it is preferable for the cane user that the surface of gratings be of the sieve type rather than the flat elongated grid type. If the gratings have elongated openings they should be positioned so the long dimension is at right angles to the main pedestrian flow pattern. Solid covers occurring in walkways should not have changes in the vertical surface dimension that exceed 15 mm.

2.3.9 Parking

(a) Parking lots should conform with recommendations concerning clearance dimensions, illumination, signage and landscaping. Pedestrian access from the public transit system should not require crossing a parking lot in order to arrive at the main accessible entrance of a building.

(b) Wheel stops, landscaping, or other design features should be in place in order to prevent cars from parking so that their bumpers are protruding over the walkway.

(c) Where wheel stops or other curbing projections are present in the parking lot, these should be painted with a bright yellow colour/ brightness contrasted paint to assist their identification by low-vision pedestrians.

2.3.10 Traffic Lights for Pedestrian Walkways

(a) It is preferable that access be gained directly to the terminal's main entrance via public ground transportation without having to cross main traffic thoroughfares.

(b) When main traffic thoroughfares must be crossed to gain access to the terminal, pedestrian walkways should be provided connecting the main accessible entrance of the terminal to public transportation depots or parking lots. These walkways must be colour/brightness contrasted to their surrounding surface. It is preferable that these walkways have pedestrian-controlled traffic-light signals. The location of the signal button must be beside the crosswalk and consistently located throughout the setting for all crosswalks. It is preferable that the signal button be colour/ brightness contrasted to its immediate surroundings.

(c) Traffic light signals should be clearly visible from both sides of the crosswalk and the design of the light fixture should be of the standard

vertical position with the red light on top, yellow light in the middle, and the green light on the bottom.

(d) Auditory traffic light signals are only recommended for pedestrian crosswalks where there is no cross traffic to offer sound cues to indicate light changes, e.g. crosswalks located in the middle of a block.

Visually impaired persons rely on the auditory cues of traffic flow patterns and any residual vision they may have, to know when to cross a street safely. When properly utilized, these cues provide reliable, natural sources to assist with safe street-crossing methods. Auditory traffic signals which provide a sound cue to indicate traffic light signal changes can prove to be hazardous when their presence creates over-dependence and over-confidence on the artificial sound cue which results in less caution being exercised by the visually impaired traveller.

The possible negative effects of such over-dependency are clear when one considers: the number of vehicle drivers who continue through an intersection against a red light; the possibility of the audible sound cue of the device masking nearby traffic sounds; and potential for malfunction in the device which could conceivably result in auditory miscues. Therefore, auditory traffic light signals should only be considered for a crosswalk following the evaluation of the crosswalk setting and the recommendation of installation of such a device by the local consultation team (see 1.2).

(e) Where auditory traffic light signals are utilized, they should be closely monitored for mechanical malfunction. The auditory sound cue should be clearly audible above the ambient noise of the crosswalk area. The sound source should be emitted from the opposite side of the crosswalk to assist the pedestrian in localizing the sound source during crossing.

(f) All traffic signals must be set such that sufficient time is readily provided to pedestrians to complete the crossing.

2.3.11 Construction

(a) All recommendations outlined in 2.2.25 should also be met for exterior construction.

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